

REMARKS

In the Office Action, Paper No. 5, issued in the above-captioned application on June 3, 2003, claims 1-25, 27, 30, 32-37 and 41-66 were rejected and claims 26, 28, 29, 31 and 38-40 were objected to. In response thereto, claims 1, 3, 9, 10-13, 17, 20-22, 25, 33 41, 43, 45, 47, 49, 55, 59, 61 and 65-66 have been amended herein and claims 8, 42 and 63 have been cancelled. In addition, claim 67 has been added to more completely claim the invention. Support for new claim 67 can be found in the Specification at paragraph [0025]. Finally, the Specification has been amended to correct obvious typographical errors. No new matter has been added as a result of this amendment. Claims 1-7, 9-41, 43-62 and 64-67 are now pending for the Examiner's consideration. Reconsideration of these claims in light of the following Remarks is respectfully requested.

A. Oath/Declaration

A new declaration is required because the previously submitted declaration did not identify the citizenship of each inventor. A substitute declaration is submitted herewith to address this issue.

B. Claim Objections addressed

Claims 49 and 66 are objected to because of informalities. In response, the first line of claim 49 has been amended herein to insert the term "the" after the term "wherein," and the fourth line of claim 66 has been amended herein to insert the term "of" after the first occurrence of the term "form" to correct the informalities.

B. Rejections under 35 U.S.C. § 112, second paragraph, addressed

Claims 10, 13, and 47-65 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for various reasons.

Claim 10 was rejected for use of improper Markush language. Claim 10 has been amended herein to replace the term "or" with "and" to provide proper Markush language.

Claim 13 was rejected because there is insufficient antecedent basis for the term "hydrogen." Claim 13 depends from claim 9 and further limits the treatment step (c) of claim 9. Claim has been amended herein to recite that step (c) comprises "heating said precursor under a flow of a gaseous mixture comprising from about 0.1% up to 100% hydrogen" to clarify that the term "hydrogen" is used to define the treatment step (c). Support for this

amendment can be found in the Specification at paragraph [0026].

Claims 47, 55, 61 and 65 were rejected because there is insufficient antecedent basis for the limitation "said metal" in each claim. Claims 47, 55, 61 and 65 have been amended herein to replace "said metal" with "a metal," thereby obviating this rejection.

All of the Section 112, second paragraph rejections have been addressed, and withdrawal of this rejection is respectfully requested.

C. Rejections under 35 U.S.C. § 102(b) and 35 U.S.C. § 103(a) addressed

1. Claims 1-6, 14-24 and 47-65 were rejected under 35 U.S.C. § 102(b) as being anticipated by Pacaud et al. (U.S. Patent No. 4,976,944). This rejection is respectfully traversed.

The CAFC has stated that anticipation requires the presence in a single prior art reference of the disclosure of each and every element of the claimed invention, arranged as in the claim. *Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 1458 (Fed. Cir. 1984); *Altco Standard Corporation v. Tennessee Valley Authority*, 1 USPQ 1337, 1341 (Fed. Cir. 1986); 774 F.2d 1082 (Fed. Cir. 1985). It is asserted that Pacaud does not disclose every element of claims 1-6, 14-24 and 47-65, and therefore Pacaud does not anticipate these claims.

More specifically, independent claim 1 as amended herein recites a method of removing oxygen and water from a hydride or reactive gas. Support for this amendment can be found in the Specification at paragraphs [0001], [0011] and [0015]. Further, as stated at paragraph [0057], although many materials are able to remove oxygen in inert gas, the inventors discovered that only certain purifiers such as those described in the present invention are effective in removing oxygen from hydride gases. In contrast, Pacaud only discloses a method of removing arsine, phosphine and diborane impurities from gaseous silane (column 1, lines 7-9 and 41-48) using a sorption mass comprising copper or copper oxide deposited on a substrate (column 2, lines 30-47). The surface area of the copper oxide is about 186 m²/g (column 3, line 46).

Next, independent claims 17, 55, 61 and 65 as amended herein recite a method or purifier for removing contaminants from a hydride gas stream wherein the purifier comprises a thin layer of one or more reduced forms of an oxide of one or more metals deposited on the surface of a substrate, wherein the total surface area of the thin layer is less than 100 m²/g. Support for this amendment can be found in the Specification at paragraphs [0022] and

[0031]. Further, as stated in paragraph [0055], it was discovered that compared with the high surface area materials (which have problems with surface area degradation during conditioning procedures at high temperatures) the low surface area purifier material does not suffer surface degradation, even after being regenerated one or more times. Pacaud did not recognize this characteristic of low surface area purifiers, let alone teach or suggest using a purifier material having a reduced metal oxide with a surface area less than 100 m²/g.

Finally, independent claims 21 and 47 as amended herein recite a method of removing contaminants from a hydride gas stream using a purifier material comprising a reduced form of an oxide of one or more metals selected from the group consisting of vanadium, molybdenum, antimony, bismuth, tin, cerium, chromium, cobalt, tungsten, and mixtures thereof. Support for this amendment can be found in the Specification at paragraph [0022]. In contrast, Pacaud only teaches a purifier comprising copper or copper oxide.

Thus, since there is no teaching or suggestion in Pacaud that the copper oxide of the Pacaud sorption mass would be effective in removing oxygenated impurities such as oxygen and water from a hydride gas, one skilled in the art would not be motivated by Pacaud to use his copper oxide sorption mass in a method to remove oxygenated impurities from a hydride gas. Further, there is no teaching in Pacaud of a purifier material comprising a thin layer having a surface area less than 100 m²/g, nor is there any teaching that purifier material having a surface area less than 100 m²/g would be effective in removing impurities from a reactive or hydride gas. Accordingly, since the above-described distinguishing features of (1) removing oxygen and water from a hydride gas and/or (2) using a substrate with a thin layer having a surface area less than 100 m²/g and/or (3) a reduced form of an oxide of a metal selected from the group consisting of selected from the group consisting of vanadium, molybdenum, antimony, bismuth, tin, cerium, chromium, cobalt, tungsten, and mixtures thereof are neither taught nor suggested by Pacaud, independent claims 1, 17, 21, 47, 55, 61 and 65 and the claims that depend therefrom are novel and nonobvious in view of Pacaud. Dependent claims 52 and 63 have been cancelled herein. Withdrawal of this rejection is respectfully requested.

2. Claims 41-46 were rejected under 35 U.S.C. § 102(b) as being anticipated by, or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Pacaud et al. (U.S. Patent No. 4,976,944). This rejection is respectfully traversed.

Claim 41 as amended herein recites a purifier material comprising a thin layer of one

or more reduced forms of an oxide of one or more metals deposited on the surface of a substrate, wherein the total surface area of the thin layer is less than 100 m²/g. As stated above, there is no teaching in Pacaud of a purifier material comprising a thin layer having a surface area less than 100 m²/g or even a suggestion that purifier material having a surface area less than 100 m²/g would be effective in removing impurities from a reactive or hydride gas. Since Pacaud fails to teach or suggest this distinguishing feature, claim 41 and claims 42-46 which depend therefrom are novel and nonobvious in view of Pacaud. Withdrawal of this rejection is respectfully requested.

3. Claims 1-3, 5, 8-13, 21-22, 25, 27, 30, 32-33, 35-37, 41, 44-47, 50-51, 53-54, 61-62 and 66 were rejected under 35 U.S.C. § 102(b) as being anticipated by Shadman (U.S. Patent No. 5,637,544). This rejection is respectfully traversed.

Claim 8 has been cancelled. Independent claims 1, 21, 25 and 66 as amended herein recite a method, material or method of making a material for removing contaminants from a hydride or reactive gas using a purifier material consisting essentially of a nonreactive substrate having a surface and a thin layer of one or more reduced forms of oxides or one or more metals deposited on the substrate surface. Support for this amendment can be found in the Specification at paragraphs [0019], [0021], [0022], [0031] and [0044]. Further, independent claim 47 has been amended herein to include the limitations of cancelled claim 52 and recites that the purifier material comprises a nonreactive substrate having a surface and a thin layer of reduced forms of oxides or one or more metals deposited on said substrate surface, wherein said metal is selected from the group consisting of vanadium, molybdenum, antimony, bismuth, tin, cerium, chromium, cobalt, tungsten, and mixtures thereof.

In contrast, Shadman discloses a method for removing impurities from an inert gas or a reactive gas, but only provides oxygen, silane, HCl or HBr examples of such gases. The Shadman method utilizes a purifier material comprising an inorganic substrate, at least one carbon layer deposited on the surface of the substrate, and a metal oxide species chemically bonded to the carbon layer (column 2, lines 49-52 and lines 56-60). The chemical bond is required in order to anchor the reactive metal species to the carbon, and the carbon in turn is anchored to the substrate (column 6, lines 52-53). There is no teaching or suggestion in Shadman that the intermediate carbon layer could be eliminated from his purifier material and that such a modified purifier could be used effectively in a gas purification method for purifying hydride gases. As stated in the present application at paragraph [0057], the

inventors discovered that although many materials are able to remove oxygen in an inert gas, only certain purifiers such as those described in the present invention are effective in removing oxygen from hydride gases such as ammonia. This discovery is neither taught nor suggested in Shadman and can only be found in the present invention.

Next, independent claim 25 of the present invention recites a method of preparing a purifier material comprising providing a coated precursor consisting essentially of a nonreactive substrate having a surface and a thin layer of one or more metals of a first oxidation state deposited on the substrate surface. Subsequent heating and treatment steps provide a purifier material consisting essentially of the nonreactive substrate having a thin layer of one or more reduced forms of an oxide of one or more metals deposited on the surface of the substrate. It is well known that the transitional phrase "consisting essentially of" limits the scope of a claim to the specified materials or steps and those that do not materially affect the basic and novel characteristic(s) of the claimed invention. In contrast, Shadman discloses a method of making a purifier material comprising first depositing at least one layer of carbon on an inorganic substrate and then depositing a precursor metal species on the carbon layer to form a membrane. This three-layered structure is then heated to form active sites on the membrane comprising partially deoxygenated metal species chemically bonded to the carbon layer. Thus, since Shadman clearly requires a carbon layer for an effective purifier material and the transitional phrase in independent claim 25 excludes a critical step of the Shadman method (i.e., depositing a carbon layer on the substrate), claims 25 and claims 27, 30, 32, 33, 35, 36 and 37 which depend therefrom are novel and nonobvious in view of Shadman.

Accordingly, since the above-described distinguishing features are neither taught nor suggested by Shadman, claims 1-3, 5, 8-13, 12-22, 25, 27, 30, 32-33, 35-37, 41, 44-47, 50-51, 53-54, 61-62 and 66 are neither anticipated by or obvious in view of Shadman. Withdrawal of this rejection is respectfully requested.

D. Rejections under 35 U.S.C. § 103(a) addressed

1. Claims 7 and 34 are rejected under 35 U.S.C. §103(a) as being unpatentable over Shadman. This rejection is respectfully traversed.

Claims 7 and 34 depend from claims 1 and 25, respectively, and therefore are believed to be allowable as depending from allowable base claims. Further, claim 7 recites

that the reactive gas is selected from the group consisting of trimethyl aluminum, trimethyl gallium and trimethyl indium. Not only is Shadman silent with respect to these specific reactive gases, but Shadman does not even suggest that his purifier material would be successful in removing oxygen and/or water from these reactive gases. Rather, the inventors were the first to discover this unexpected property of the inventive purifier materials. For this additional reason, claim 7 is believed to be nonobvious in view of Shadman. Claim 34 further recites that the metal oxide in the purifier material is an oxide of a metal selected from the group consisting of vanadium, molybdenum, antimony, bismuth, tin, cerium, chromium, cobalt, copper tungsten, and mixtures thereof. In contrast, Shadman at column 2, lines 31-32 discloses purifier materials containing magnesium, manganese and alkali metals. However, Shadman fails to teach that the metals recited in claim 34 would be effective in removing oxygen and/or water from reactive gases. For this additional reason, claim 34 is believed to be nonobvious in view of Shadman. Withdrawal of this rejection is respectfully requested.

E. Allowable subject matter

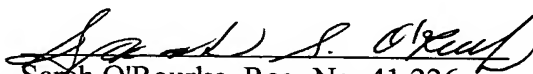
The Examiner states that claims 26, 28-29 31, and 38-40 are objected to as being dependent upon a rejected base claims, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. It is appreciated that these claims would be allowable if rewritten as the Examiner suggests. However, Applicants wish to continue prosecution of claims 26, 28-29 31, and 38-40 as currently pending.

CONCLUSIONS

It is believed that all claims pending in this patent application are now allowable. Therefore, it is respectfully requested that the Examiner reconsider his rejections and to grant an early allowance. The fees associated with the Petition for a one month time extension accompanies this response. No additional fees are believed to be due as a result of the filing of this Amendment. However, the Examiner is authorized to charge any fee deficiency associated with this response to Deposit Account No. 50-1123. If any questions or issues remain to be resolved, the Examiner is requested to contact the undersigned at the telephone number listed below.

Respectfully submitted,

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Dated


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